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EXAMINER
BLOOM, NATHAN J

ART UNIT	PAPER NUMBER
2624	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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	Application No.	Applicant(s)
Office Action Summary	10/717,621	KIM ET AL.
	Examiner	Art Unit	
	NATHAN BLOOM	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _02 April 2008_.
2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-75_ is/are pending in the application.
    4a) Of the above claim(s) _12-24, 47-59, and 72_ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) _1-6,9-11,25,26,28-30,32-41,44-46,60-63,66-71 and 73-75_ is/are rejected.
7)☒ Claim(s) _7,8,27,31,42,43,64 and 65_ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☒ All   b)☐ Some * c)☐ None of:
      1.☒ Certified copies of the priority documents have been received.
      2.☐ Certified copies of the priority documents have been received in Application No. _____.
      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
         application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.
5)☐ Notice of Informal Patent Application
6)☐ Other: _____.

DETAILED ACTION

Applicants' response to the last Office Action, filed on April 2nd, 2008 has been entered

and made of record.

Claim Rejections - 35 USC § 103

1.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

2.   Claims 1, 3-6, 25-26, 29-30, 36, 38-41, 60-63, 71, and 73-74 are rejected under 35 U.S.C.

103(a) as being unpatentable over Dougall (US 5019903) in view of Greggain (US 6219464).

Instant claim 1: An apparatus for enhancing the quality of a reproduced ~~images~~ image

comprised of a plurality of pixels having original pixel values corresponding to the image,

comprising:

a vertical area existence determination unit which determines whether or not an edge

included in an input pixel selected from the plurality of pixels belongs to a vertical area;

[*Greggain teaches in figures 1-3, 10, item 104 of figure 8, and column 5 line 45 to column 6 line*

25, a method of directional interpolation for scaling an image based on the measurement of

vertical and diagonal (slant line) absolute differences (the measure of possibility) of the pixels

in rows above and below the input pixel (pixel to be interpolated), but since Greggain teaches

scaling of an image the input pixel (pixel to be interpolated) does not have a previous (original)

pixel value. However, Dougall discloses a method of directional interpolation based on pixels of

even and odd fields (interlaced video frames) wherein the input pixel (pixel to be interpolated)

had a previous value. It would have been obvious to one of ordinary skill in the art at the time of

the invention to modify the directional interpolation method of Dougall with the method taught

by Greggain to improve the accuracy of the directional interpolation. Additionally, Greggain's

method allows for fractional resizing of the image (column 1 lines 60+).]

a slant line possibility determination unit which determines whether or not there is a

possibility of the edge forming a slant line when the edge is determined to not belong to the

vertical area; [*Greggain teaches in figures 1-2, column 5 line 45 to column 6 line 25, the taking*

of the absolute difference (the measure of possibility) of the pixels in the slant line and vertical

directions (Figure 10 and 104 of Figure 8).]

a direction determination unit which determines a direction of the slant line when the

edge is determined to possibly form the slant line; and [*Greggain teaches in column 6 line 25 to*

column 7 line 59, the determination of the edge direction based on the comparison of absolute

values to particular thresholds (Figure 10 and 104 of Figure 8).]

an interpolation unit which calculates an interpolated pixel value for the input pixel based

on the determination results provided by the vertical area existence determination unit, the slant

line possibility determination unit, and the direction determination unit. [*Greggain teaches in*

column 7 lines 25-32 the interpolation in a determined direction (vertical or one of the oblique

angles), based on the vertical/slant line possibility determination. Also see Figure 8, wherein

Greggain teaches that the interpolated value is output as w (item 106 of figure 8).]

Instant claim 3: The apparatus of claim 1, wherein the vertical area existence determination unit

determines that the input pixel exists in the vertical area when a difference (a) between values of

upper and lower pixels, vertically adjacent to the input pixel, is smaller than a predetermined

threshold value and determines that the input pixel exists in the slant line area when the

difference (a) is greater than the predetermined threshold value. [*See column 6 lines 25-40 (see*

Figures 7A and 7B for the flowchart) of Greggain, wherein if the vertical difference is below the

threshold (threshold is the lowest of the difference of the 2 oblique directions) the vertical

direction is chosen, and if the vertical difference is greater than the threshold (minimum oblique

difference) then the oblique (slant) direction is chosen.]

Instant claim 4: The apparatus of claim 1, wherein the slant line possibility determination unit

determines that the edge included in the input pixel may have a slant-line shape when a

predetermined number of values among differences between values of two pixels, arranged at

each side of the upper pixel, and values of their vertically corresponding pixels are not smaller

than the predetermined threshold value and are obtained using two pixels located at one or the

other side of the upper pixel and their diagonally corresponding pixels. [*See column 6 lines 25-40*

(see Figures 7A and 7B for the flowchart) of Greggain, wherein either of the two pixels in the top

row can be considered the upper pixel. If at least one of the oblique (slant) direction differences

is below the threshold (threshold is the difference in the vertical direction) the interpolation is performed in the oblique direction. As can be seen in figures 1-3 the pixels are arranged at either side and differences are of the diagonally corresponding pixels.]

Instant claim 5: The apparatus of claim 1, wherein:

an upper pixel is arranged above in an upper position vertically adjacent to the input pixel, [*See figure 4 of Dougall, wherein the pixel to be interpolated is the X pixel.*]

a lower pixel is arranged in a lower position vertically adjacent to the input pixel, [*See above.*]

a first pixel pair is horizontally arranged at one side of the upper pixel, [*See above.*]

a second pixel pair is horizontally arranged at the opposite side of the upper pixel, [*See above.*]

a third pixel pair is horizontally arranged at one side of the lower pixel and, with respect to the input pixel, arranged diagonally to the first pixel pair, and [*See above.*]

a fourth pixel pair is horizontally arranged at the opposite side of the lower pixel and, with respect to the input pixel, arranged diagonally to the second pixel pair, and [*See above.*]

the slant line possibility determination unit determines that the edge included in the input pixel may have a slant-line shape when:

differences between values of <u>each of the first pixel pair</u> ~~two pixels, arranged at one side of the upper pixel,~~ and values of ~~their diagonally corresponding pixels~~ <u>a diagonally corresponding pixel of the third pixel pair,</u> are smaller than the difference [[(a)]] between <u>the</u> upper <u>pixel</u> and <u>the</u> lower <u>pixel</u> ~~pixels that are vertically adjacent to the input pixel~~, and [*See below.*]

the difference between values of <u>each of the first pixel pair</u> ~~two pixels arranged at one side of the upper pixel,~~ and values of ~~their diagonally corresponding pixels~~ <u>a diagonally corresponding pixel of the third pixel pair,</u> are also smaller than differences between values <u>each of the second pixel pair</u> ~~of two pixels arranged at the other side of the upper pixel,~~ and values of <u>the respective pixels of the fourth pixel pair</u> ~~their diagonally corresponding pixels~~.

[*Greggain teaches in column 6 lines 25-40 (see Figures 7A and 7B for the flowchart), wherein either of the two pixels in the top row can be considered the upper pixel. If at least one of the oblique (slant) direction differences is below the threshold (threshold is the difference in the vertical direction) the interpolation is performed in the oblique direction. Also, Greggain teaches in column 6 line 25 to column 7 line 40 (figures 1-3 of Greggain, diagonally corresponding differences) that the corresponding diagonal direction is selected based on being smaller than the other. However, Greggain only teach the differencing between single pixels and not pairs of pixels. Dougall teaches (see figure 4) the differencing of opposing pixels pairs, and the positioning of upper and lower pixels. As per the rejection of instant claim 1 it would have been obvious to one of ordinary skill in the art to combine the teachings of Greggain and Dougall to modify the video deinterlacing interpolation method using the thresholding and directional determination method of Greggain (comparing slant and vertical directions to thresholds, see*]

the rejection of claim 1). Furthermore, as taught by the Dougall the upper and lower pixels (see

figure 4) are the vertical difference and the diagonal pixel differences are the corresponding

adjacent (to upper/lower pixel) and diagonally opposing (with respect to pixel to be

interpolated) pairs of the pixels. Thus, in view of Dougall the oblique differences are pairs of

pixel differences.]

Instant claim 6: The apparatus of claim 1, wherein the direction determination unit comprises:

      a direction estimator which estimates the direction of the slant line when it is determined

that there is a possibility of the edge having a slant-line shape; and [*See rejection of instant claim*

1 wherein direction is selected/estimated based on minimum value criteria.]

      a precision determiner which determines precision of the estimation. [*Greggain teaches a*

measure of precision in lines 14-25 of column 7. The particular section states that there is a

minimum allowable difference (between the magnitude of the differences of the oblique

directions) that must be met else the vertical direction is chosen. This threshold is a

determination of whether or not there is minimal difference (possibly due to just noise) wherein

when the difference between is lower than the minimal threshold the precision of this direction

(oblique) decision is low and thus the direction defaults to a vertical direction.]

Instant claims 25-26, 60, and 62 are encompassed by the limitations of instant claims 1, 4, 6 and

7 and as per rejection of instant claims 1, 4, 6, and 7 the apparatus of claims 25-27 and the

method of claims 60, 62, and 64 have been disclosed since the disclosed apparatus performs the

method (See figures 7A&B of Greggain show method flowchart and corresponding disclosure in specification.).

Instant claims 29-30, 61, and 63 are encompassed by the limitations of instant claims 1, 5 and 6 and as per rejection of instant claims 1, 5, and 6 the apparatus of claims 29-30 and the method of claims 61 and 63 have been disclosed since the disclosed apparatus performs the method (See figures 7A&B of Greggain show method flowchart and corresponding disclosure in specification.).

Instant claims 36 and 38-41 are encompassed by the limitations of instant claims 1 and 3-6 and as per rejection of instant claims 1 and 3-6 the method of claims 36 and 38-41 have been disclosed since the disclosed apparatus performs the method (See figures 7A&B of Greggain show method flowchart and corresponding disclosure in specification.).

Instant claims 71 and 73-74 encompass the computer readable media that perform the method of claims 36 and 60-61. As per rejection of instant claims 36 and 60-61 the method has been disclosed. However, Dougall and Greggain do not disclose the storing or implementation of the methods in software. Examiner takes Official Notice that it was notoriously well known to one of ordinary skill in the art at the time of the invention to implement interpolation methods to be performed by a computer. Furthermore, the implementation of such a method in software allows for easy manipulation of the method, and the use of a cheap, highly available, and portable multi-purpose apparatus (computer).

3.   Claims 10, 33, 45, 68 and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dougall and Greggain as applied to claims 1 and 6 above, and further in view of Westerman (US 6262773).

Instant claim 10: The apparatus of claim 1, wherein the interpolation unit obtains the interpolated pixel value using values of upper three cells and lower three pixels with respect to the input pixel, which belong to the same row as the input pixel but different columns from one another, when the edge included in the input pixel is determined to belong to the vertical area, and obtains the interpolated pixel value using the values of four pixels diagonally adjacent to the input pixel when the edge included in the input pixel is determined to belong to the slant line area. [*Dougall and Greggain have taught the use of 2 upper and 2 lower pixels for interpolation as can be see in figure 1 of Greggain, but do not teach the use of more than 2 pixels in a row or the interpolation of more than 2 pixels (4 in particular) in the slant direction. However, the use of four or more pixels in a row and the interpolation of 4 or more pixels has been taught by Westerman in figures 8-17 and column 9 line 35 to column 10 line 57, which describes the pixel to be interpolated as the X and the pixel to be used for interpolation as the slant selection as can be clearly seen figure 17. It would have been obvious to one of ordinary skill in the art to combine the teachings of Westerman with Dougall and Greggain to reduce the error of the interpolated value by increasing the number of data-points used for edge determination and interpolation.*]

Instant claims 33 and 68 are encompassed by the limitations of instant claim 10 and as per

rejection of instant claim 10 the apparatus of claim 33 and the method that the apparatus

performs as is described in claim 68 have been disclosed (See figures 7A&B of Greggain).

Instant claim 45 are encompassed by the limitations of instant claim 10 and as per rejection of

instant claim 10 the corresponding method of claim 45 have been disclosed since the disclosed

apparatus performs the method. Furthermore, figures 7A&B of Greggain show the method

flowchart.

Instant claim 75 is the computer readable medium that performs the method of claim 68. As per

rejection of instant claims 68 and 71 the method and corresponding CRM have been disclosed.

4.   Claims 2, 11, 37, 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Dougall and Greggain as applied to claim 1 above, and further in view of Takeda (US 5894329).

Instant claim 2: The apparatus of claim 1 further comprising an adjusted pixel value calculation

unit which compares the interpolated pixel value with an original input pixel value and adjusts

the interpolated pixel value based on the comparison result. [*Greggain and Dougall have taught*

a method of deinterlacing, but do not teach the comparison of the interpolated pixel value with

that of the original (or pervious/next pixel). However, Takeda teaches in column 3 line 60 to

column 4 line 7 an interlaced to progressive conversion method in which the pixel of the

previous scan line is compared to the interpolated pixel and if comparison result greater than a

threshold the interpolated data is used (if less than the original or previous scan line data is used

for that particular pixel). It would have been obvious to combine Dougall and Greggain with

Takeda to reduce the amount of pixel error caused by the conversion method.]

Instant claim 11: The apparatus of claim 2, wherein:

the adjusted pixel value calculation unit designates the original input pixel value as an

output pixel value when a difference between the interpolated pixel value and the original input

pixel value is not greater than a predetermined threshold value, and

designates the interpolated pixel value as the output pixel value when the difference

between the interpolated pixel value and the original input pixel value is greater than the

predetermined threshold value. [*See rejection of instant claim 2.*]

Instant claims 37 and 46 are encompassed by the limitations of instant claims 2 and 11 and as per

rejection of instant claims 2 and 11 the method of claims 37 and 46 have been disclosed since the

disclosed apparatus performs the method. Furthermore, figures 7A&B of Greggain show the

method flowchart and the method steps for Takeda are listed within the same section referenced

above.

5.   Claims 34-35 and 69-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Greggain Dougall in view of Westerman as applied to claim 10 above, and in further view of

Takeda as applied to claims 2 and 11.

Instant claims 34-35 and 69-70 are encompassed by the limitations of instant claims 2 and 10-11.

The rejection of instant claims 2 and 11 by Dougall and Greggain in view of Takeda taught the

comparison of the interpolated pixel to that of the original pixel and would have been obvious to

one of ordinary skill in the art to combine the teachings of Dougall and Greggain with Takeda to

reduce the amount of pixel error caused by the conversion method. Furthermore, the rejection of

instant claim 10 by Dougall and Greggain in view of Westerman taught that the differencing and

interpolation of additional pixels, and would have been obvious to one of ordinary skill in the art

to combine the teachings to increase the accuracy of the directional interpolation technique as

taught by Greggain. Thus, as per rejection of instant claims 2 and 10-11 the apparatus of instant

claims 34-35 and the method of instant claims 69-70 have been disclosed since the apparatus

performs the method. Furthermore, the additional limitation in claims 33-35 and 68-70 (that is

not in claim 10) that the fields are odd/even fields has been disclosed by Dougall (teaches

deinterlacing).

6.   Claims 9, 28, 32, 44, and 66-67 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Dougall and Greggain as applied to claims 1 and 3-4 above, and further in view of Yoo (US

2003/0112369).

Instant claim 9: The apparatus of claim 6, wherein the precision determiner determines the

estimation of the direction of the slant line to be precise when the direction estimator estimates

the slant line to be tilted rightward (or leftward), the difference a between the values f and k of

the upper and lower pixels, a difference between k and a value g of an upper right pixel, a

difference between g and a value j of a lower left pixel, and a difference between f and j are not

smaller than a predetermined threshold value. [*Dougall and Greggain teach the differencing of*

upper and lower pixels, but do not teach the use of a threshold value for comparing these

absolute values to in order to measure the precision of the directional choice. However, Yoo in

paragraph 0085 teaches the comparison of the directional differences to a threshold value

(TH_VAL) and if the values are less than the threshold then the chosen leftward/rightward

(positive/negative slope) directionality are considered imprecise at which point a reevaluation of

the directionality is performed.]

Instant claims 28, 32, 44, and 66-67 are encompassed by the limitations of instant claims 3-4 and

9 and as per rejection of instant claims 3-4 and 9 the apparatus of claims 28, 32 and the method

of claims 44 and 66-67 as performed by the disclosed apparatus have been disclosed.

Allowable Subject Matter

7.   Claims 7-8, 27, 31, 42-43, and 64-65 objected to as being dependent upon a rejected base

claim, but would be allowable if rewritten in independent form including all of the limitations of

the base claim and any intervening claims. (Note: Reasoning noted in prior office action.)

Response to Arguments

8.   Applicant's arguments with respect to claims 1-11, 25-46, 60-71, and 73-75 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9.   The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Sun, T. and Neuvo, Y. 1994. "Detail-preserving median based filters in image processing" – teaches substitution of calculated pixel value for that of the original pixel values based on conditional statements.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed, can be reached on 571-272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NB

/Samir A. Ahmed/
Supervisory Patent Examiner, Art Unit 2624